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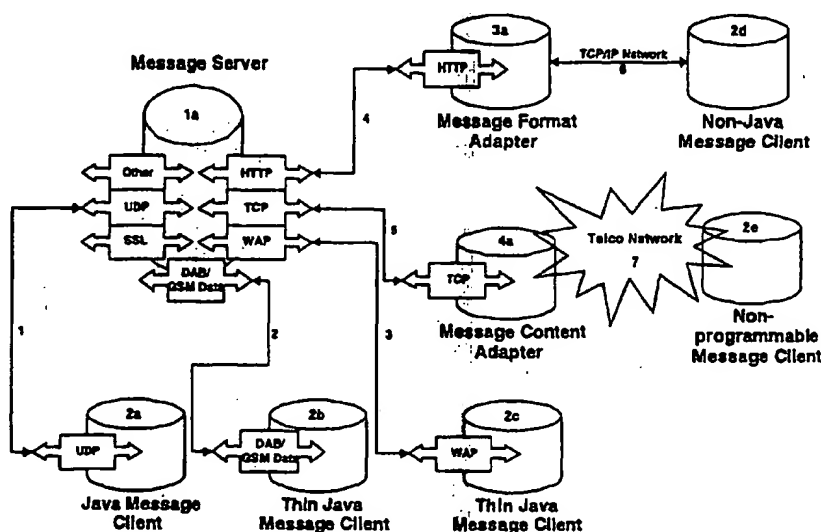
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(54) Title: **MESSAGING SYSTEM**



(57) Abstract: A messaging system is disclosed for the purpose of delivering data in the form of a portable message format from a producer of any kind, over any transport protocol, using any delivery guarantee, to one or more recipients of any kind. The method for running said message system includes a message broker with at least one pluggable protocol adapter. It may also comprise at least one pluggable message format adapter and at least one pluggable message content adapter, thus enabling to use a simple unified topic or queue abstraction between the involved communication parties. Specifically, the method includes protocol adapters, message format adapters and message content adapters to wireless networks and devices, as well as message adapters to convert the portable messages between the different formats used in different computer programming languages.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## Messaging system

### Field of the invention:

The invention relates to techniques for the delivery of electronic messages between  
5 hardware or software components over any kind of network (wired and wireless),  
between any kind of devices.

### Background of the invention:

Message oriented middleware (MOM) has been available for many years. In October  
1998, an industry standard emerged from Sun Microsystems, the Java Message  
10 Service (JMS). At a programming interface level, this standard describes how a  
messaging middleware is accessed from a piece of Java code. The two main  
abstractions are "topics" (publish / subscribe messaging) and "queues" (point-to-point  
messaging). While the standard describes the interface to the messaging  
middleware, the implementation of the middleware is not specified. Also, integration  
15 of non-Java programming languages is not specified, and integration of non-  
programmable messaging devices (such as phones or pagers) are not specified.

Existing messaging middleware allows one to access the middleware over a fixed,  
small number of transport protocols. These are usually TCP or SSL. Supporting a  
new protocol requires the vendor of the middleware to implement it and to integrate it  
20 into the middleware. Non-Java devices may or may not be supported, but again,  
extending the middleware for as yet unsupported devices requires the vendor of the  
middleware to enable it. Non-programmable devices are unsupported in current  
messaging middleware products.

This leads to:

- Performance impacts, as TCP or SSL are unicast transport protocols, while the publish/subscribe pattern is a multicast abstraction.
- 5 • Limited applicability, as devices using a new kind of transport protocol are not supported. This is especially true for wireless small devices, such as PDAs or mobile phones, which today cannot be part of a uniform messaging infrastructure.
- Limited applicability, as non-programmable devices (such as a mobile phones with a built-in messaging function, e.g. Short Message Service (SMS)) cannot participate in a uniform messaging infrastructure.
- 10 • A limited choice of message delivery guarantees, resulting in potentially too strong guarantees (which are too expensive) or too weak guarantees (too many messages are lost undetected). This is inadequate especially for wireless networks.
- No support of asymmetrical networks, such as a cheap, best-effort bulk downlink  
15 for the actual delivery of messages, and a more expensive, reliable uplink for control data to implement the desired quality of service, i.e. message delivery guarantee.

### **Object of the invention:**

A first object of the invention is to provide a messaging system for the delivery of  
20 data in the form of portable message formats between message clients using transport protocol adapters and any kind of network. Another object of the invention is to provide a method for messaging simple logical communication topics or message queues that are independent of transport protocols, delivery guarantees, message format, and message content limitations. Another object of the invention is  
25 to provide a computer program product directly loadable into the memory of a computer usable for running a messaging system.

## Summary of Invention:

The messaging system outlined in this disclosure is a major technological advancement enabling users to deliver messages over any transport protocol, using an optimized message delivery guarantee, and to any kind of device.

- 5 A messaging system is disclosed for delivering data in the form of portable message formats from a producer of any kind, over any transport protocol, using any delivery guarantee, to one or more recipients of any kind. The method for running said message system includes a message broker with a system architecture of at least one pluggable protocol adapter. Said system architecture may comprise also at least
- 10 one pluggable message format adapter and at least one pluggable message content adapter, thus enabling to use a simple unified topic or queue abstraction between the involved communication parties.

- Specifically, the method includes protocol adapters, message format adapters, and message content adapters to wireless networks and devices, as well as message
- 15 adapters to convert the portable message between the different formats used in different computer programming languages. Data may be delivered using asymmetric networks where the forward and return channels may be realized using two simplex channels, and networks with only a unidirectional channel.

- The invention comprises also a computer program product directly loadable into the
- 20 memory of a computer usable for running a messaging system.

## Detailed description Of The Drawing:

Fig. 1 provides a block diagram of a preferred embodiment of the present invention. It consists of:

- A message server 1a.
- 5 • A Java message client 2a, connected via an IP multicast connection 1.
- A Thin Java message client 2b, connected over an asymmetric wireless transport protocol 2.
- A Thin Java message client, 2c, connected over a wireless transport protocol 3.
- A Non-Java message client 2d, connected over a Network 6 link to the message  
10 format adapter 3a.
- A non-programmable message client 2e, connected over a telecommunications network (e.g. GSM) 7 to the message content adapter 4a.
- A message format adapter 3a, connected to the message server via an HTTP connection 4.
- 15 • A message content adapter 4a, connected to the message server via a TCP connection 5.

The block diagram is but one example of a messaging infrastructure deployment. Any number of message servers, message clients, message format adapters and message content adapters can be present in a specific installation.

- 20 The message server 1a maintains client connections, administers client subscriptions to topics and queues, receives and forwards messages, and stores persistent

messages in its database. These activities are standard activities of a message server.

The message server **1a** comprising at least one pluggable transport protocol adapter. **Fig. 1** shows an example of six specific transport protocol adapters (UDP, SSL, HTTP, TCP, WAP, DAB/GSM Data). A placeholder is present (labeled "Other") for any number of additional protocol adapters.

On startup, the message server **1a** reads its configuration data, and initializes all configured protocol adapters. At runtime, additional protocol adapters can be started, or running protocol adapters can be stopped, without interrupting the message server service (however, if a specific protocol adapter is stopped, service over this adapter is no longer available).

At least one message client **2a-2e** connects to the message server **1a** using its configured protocol adapter. If a matching protocol adapter is running on the server, the connection is successful. Further communication between message client and message server is according to the familiar publish/subscribe or point-to-point pattern of JMS.

JMS topics or JMS queues are named and administered independently of the protocol adapters involved. If a client connects to the server using the "TCP" protocol adapter, it can communicate with a client that connected using the "UDP" protocol adapter, if both clients use the same JMS topic or queue.

The protocol adapters encapsulate at least one logic needed to:

- Interface with a transport protocol, such as HTTP, TCP or GSM Data.
- Specify and guarantee a quality of service for the message delivery.

Certain transport protocols operate in a "best effort" delivery mode. Thus, simply adapting to a specific protocol is not always enough (unless "best effort" is the desired message delivery guarantee). Thus, protocol adapters consist of both the

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transport protocol mechanism, and a quality of service mechanism to improve the basic network delivery guarantee.

The Java message clients **2a-2c** implements the JMS API from Sun Microsystems. It cooperates with the message server to achieve full JMS functionality.

- 5 Specific to the present invention is the pluggable transport protocol adapter architecture. A message client **2a-2e** can use any transport protocol adapter to communicate with the message server **1a**. The necessary code to implement a specific transport protocol adapter can be acquired at runtime, for example using a Java classloader mechanisms, using a lookup service such as JINI, or using a
- 10 directory service via JNDI.

- The thin Java message client **2b,2c** is a compact version of a Java message client. It is able to operate without any network support from the Java environment. Specifically, the java.net, java.io and java.rmi libraries are not required. This is possible because of the pluggable transport protocol adapter architecture. The
- 15 protocol adapter to access e.g. an infrared port on a mobile device directly interfaces with the infrared hardware. Thus, it does not require any TCP/IP emulation on top of the infrared hardware to be present.

- The Non-Java message client **2d** connects for example via a TCP link to the message format adapter. It consists of a JMS-like programming library, that offers to
- 20 non-Java devices JMS functionality, as well as full integration with Java message clients.

The non-programmable message client **2e** is any device that has its own method to interchange messages with other devices. Examples include:

- GSM Phones, using the Short Message Service (SMS).
- 25 • Alphanumeric pagers.
- WAP enabled phones.



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A non-programmable message client 2e needs for example a specific message content adapter to integrate into the messaging system, i.e. to exchange messages with other client types.

5 The JMS message format is specific to Java and JMS. Non-Java programmable clients need a translation engine to convert the Java message into a message they can deal with. This translation engine is the message format adapter 3a. According to Fig. 1, the message format adapter 3a is a generic proxy. On one side, it connects to the message server 1a using any pluggable transport protocol adapter. On the other side, it communicates with the Non-Java message client 2d using a command  
10 protocol over a communication such as TCP/IP. The command protocol supports the entire JMS command set, such as "publish" or "subscribe". JMS object messages are introspected using the Java introspection mechanism. The result of the introspection is translated into a byte stream and exchanged with the Non-Java message client 2d over the TCP/IP link.

15 Non-programmable clients usually have restrictions regarding the size and format of the messages they support. For example, the GSM SMS specification allows only text, with a maximum length of 160 characters. Additionally, the non-programmable clients don't follow JMS, or the publish/subscribe or point-to-point programming pattern. Thus, other means for e.g. topic registration must be used.

20 The message content adapter 4a is described generically, but must be specifically adapted to each non-programmable message client. There is e.g. a SMS message content adapter, a WAP message content adapter or a pager message content adapter.

25 According to Fig. 1, the message content adapter 4a is a proxy that on one side connects to the message server 1a using any pluggable transport protocol adapter. On the other side, it communicates either directly with the non-programmable message clients, or with existing telecommunications equipment (such as an SMS gateway) that then communicates with the non-programmable message clients.

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Topic subscription is handled with a specific command protocol. In some cases, this command protocol must be known to the user (e.g. with SMS a message "subscribe:/news/sports/" needs to be sent to a specific service number). In other cases, the subscription command can be hidden from the user (e.g. with WAP, the actual subscription command can be hidden below a descriptive link).

Message adaptation is done with knowledge of the properties of the non-programmable message client. E.g. a GSM phone using SMS needs to receive a text string of at most 160 characters. An incoming Java message is thus introspected, and text content is extracted. If the text content is more than 160 messages, it is truncated. In the other direction, a published SMS message is converted into a JMS text message. Likewise scenarios exist for other non-programmable message clients.

As the messaging system comprises a computer, a computer program product comprising a software code for performing the steps of the invention can be directly loaded into the memory of said computer of the messaging system.

One example of such a messaging system is applicant's SoftWired iBus//MessageServer computer program product. This computer program product is being delivered in the form of an installable software packet. This software packet is installed on a hardware server such as a common Intel-based PC or a Sun Sparc based Unix computer. This computer program product is directly loadable into the memory of such a computer. After installation, a message server 1a can be started. As part of the message server, at least one pluggable transport protocol adapters is being delivered. Transport protocol adapters are in the form of a set of software components, i.e. Java classes. One example is the protocol adapter for the "reliable IP multicast" transport, which consists of the Java classes DISPATCH, FRAG, FIFO, NAK, REACH and IPMCAST. By configuring/implementing the above classes in the proper order in the message server configuration file, the "reliable IP multicast" transport adapter is initialized and started/plugged at runtime by the message server.

In summary, any number of protocol adapters can be activated in the message server by specifying them in the server configuration file and by delivering and installing the necessary Java classes to implement the protocol adapter.

5 Java Message Clients or Thin Java Message Clients implement the necessary logic in the form of a library, i.e. a Java Archive (JAR). This Java Archive is installed and started on a client computer. Protocol adapters are implemented and configured the same way as on the server, i.e. configured in a configuration file and delivered in the form of Java classes. The Java classes can be part of the Java Archive or can be downloaded at runtime from a web server.

10 A Message Format Adapter is in essence a special form of a Java Message Client. Thus, it consists of the same components as a Java Message Client and is configured the same way. In addition, it contains programming logic to reformat and route messages from and to the non-Java Message Clients.

15 A Message Content Adapter is in essence also a special form of a Java Message Client. Thus, it consists of the same components as a Java Message Client and is configured the same way. In addition, it contains programming logic to analyze, reformat and route messages from and to the non-programmable Message Clients.

## Glossary of terms used

- TCP: Transmission Control Protocol
- UDP: User Datagram Protocol
- IP: Internet Protocol
- 5 HTTP: Hypertext Transfer Protocol
- WAP: Wireless Application Protocol
- SSL: Secure Socket Layer
- JMS: Java Message Service (<http://java.sun.com/products/jms/>)
- PDA: Personal Digital Assistant
- 10 SMS: Short Messaging Service
- GSM: Global System for Mobile Telecommunication
- DAB: Digital Audio Broadcast

**Claims:**

1. A messaging system for delivering data in the form of portable message formats between message clients, comprising at least one transport protocol adapter,  
**wherein**  
5 at least one transport protocol is implemented before start-up of the message server and/or is implemented by a code at runtime of the message server and said at least one transport protocol adapter  
comprises a logic to interface with said at least one transport protocol,  
comprises another logic to specify a message delivery quality and  
10 is pluggable for being started and/or stopped at runtime of the message server.
2. A messaging system according to claim 1, **wherein** said at least one transport protocol adapter supports UDP or SSL or HTTP or TCP or WAP or DAB or  
15 GSM Data or GPRS or SMS or IRDA or any combination of these transport protocols.
3. A messaging system according to claim 1, **wherein** said message clients are JAVA message clients, connected via a network connection or Thin Java message clients, connected over an asymmetric wireless transport protocol, or Thin Java message clients, connected over a wireless transport protocol.
- 20 4. A messaging system according to claim 1, **wherein** it comprises at least one pluggable message content adapter.
5. A messaging system according to claim 4, **wherein** it comprises at least one pluggable message format adapter.

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6. A messaging system according to claim 5, **wherein** said message clients are Non-Java message clients, connected over a TCP/IP link to said at least one message format adapter or a non-programmable message clients, connected over a telecommunications network to said at least one message content adapter.
7. A messaging system according to claim 6, **wherein** said non-programmable message clients are devices having own methods to interchange messages with other devices.
8. A method for running a messaging system for delivering data in the form of portable message formats between message clients, comprising at least one transport protocol adapter,  
**wherein**  
at least one transport protocol is implemented during start-up of the message server and/or is implemented by a code at runtime of the message server,  
a logic of said at least one transport protocol adapter interfaces with said at least one transport protocol,  
another logic of said at least one transport protocol adapter specifies a message delivery quality and  
said at least one transport protocol adapter is pluggable for being started and/or stopped at runtime of the message server.
9. A method according to claim 8, **wherein** at least one pluggable message content adapter introspects and adapts data of a Non-Java message format into Java message format.
10. A method according to claim 9, **wherein** at least one pluggable message format adapter translates data of a Non-Java message format into Java message format.
11. A computer program product directly loadable into the memory of computer usable for running a messaging system for delivering data in the form of

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portable message formats between message clients, comprising at least one transport protocol adapter,

**wherein**

said computer program product comprises a software code for implementing at least one transport protocol before start-up of the message server and/or for at runtime of the message server,

a logic of said at least one transport protocol adapter interfaces with said at least one transport protocol,

another logic of said at least one transport protocol adapter specifies a message delivery quality and

said at least one transport protocol adapter is pluggable for being started and/or stopped at runtime of the message server.

12. A computer program product stored on a computer usable for running a messaging system for delivering data in the form of portable message formats between message clients, comprising at least one transport protocol adapter,

**wherein**

said computer program product comprises a software code for implementing at least one transport protocol during start-up of the message server and/or at runtime of the message server,

a logic of said at least one transport protocol adapter interfaces with said at least one transport protocol,

another logic of said at least one transport protocol adapter specifies a message delivery quality and

said at least one transport protocol adapter is pluggable for being started and/or stopped at runtime of the message server.

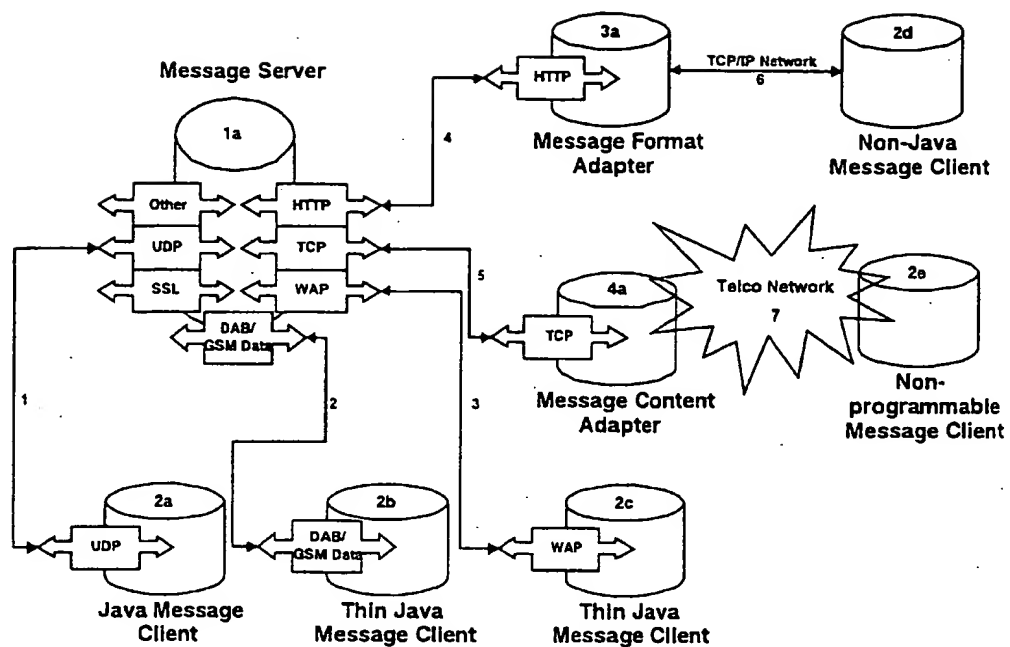


Fig. 1



## INTERNATIONAL SEARCH REPORT

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## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04L12/58 H04L29/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06F H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, IBM-TDB, PAJ, INSPEC

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Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 5 680 551 A (MARTINO II JOHN A) 21 October 1997 (1997-10-21) abstract column 5, line 50 - column 7, line 28 column 10, line 25 - line 59 figures 2,4,6,7 --- -/--	1-12



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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